Interior Acoustic Analysis for Early Use in Design, Phase I

Completed Technology Project (2011 - 2011)

Project Introduction

The design of an aircraft is a highly iterative process. During the conceptual design phase there is no time for developing detailed simulation models and decisions are typically made either by using low fidelity models or existing data and regression models. However, the decisions made during the conceptual design phase greatly affect the performance of the aircraft and the associated cost, and typically the majority of the cost is locked during very early stages of the design process. Usually the sound insulation requirements of a passenger cabin are met after the outer mold line of the aircraft and the design of the fuselage structure have been completed and this approach adds weight to the design. Ideally the structural-acoustic concerns should enter the design cycle early and be considered along with other main design disciplines. During the early design stages of an aircraft the interior noise performance of different fuselage configurations must be evaluated based on the following information: length, cross sectional stations as a function of longitudinal location, main interior arrangements, spacing and size of stiffeners and stringers, thickness and material properties of insulation blankets, thickness and material properties of the fuselage and of the trim panels, and the type of acoustic treatment placed in the interior. The acoustic performance expressed in terms of noise reduction comprises the metric for assessing the aircraft performance for interior noise considerations. The proposed project will develop an easy to use, physics based, computational capability that can provide fast an assessment for the interior noise of either conventional or novel aircraft during the early stages of the design process. It will also allow engaging information from multi-scale simulations for designing quiet composite materials with increased damping and reduced radiation efficiency characteristics.

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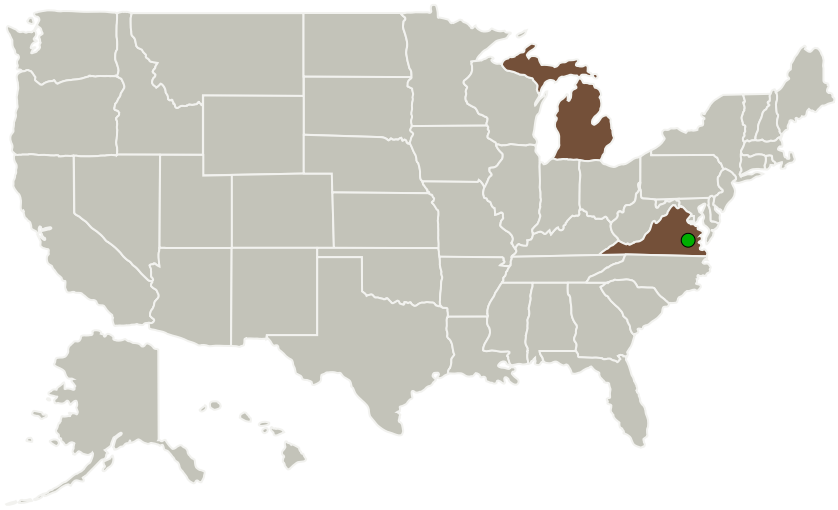
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Michigan Engineering Services, LLC	Lead Organization	Industry Women-Owned Small Business (WOSB)	Ann Arbor, Michigan
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Michigan	Virginia

Project Transitions

February 2011: Project Start

September 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138234)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Michigan Engineering Services, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

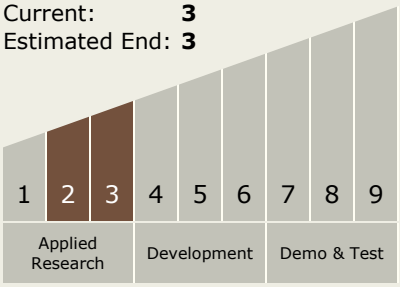
Carlos Torrez

Principal Investigator:

Jim He

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.5 Structural Dynamics
    - TX12.5.2 Vibroacoustics

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System